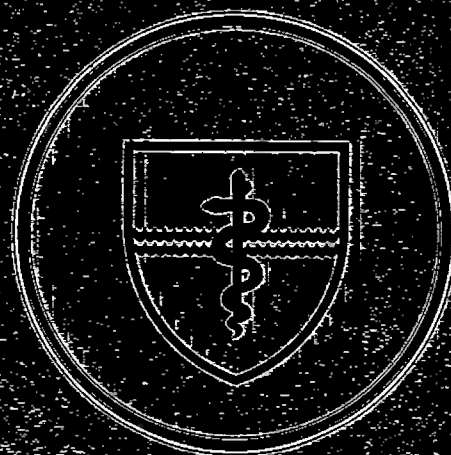


NAVAL SUBMARINE MEDICAL  
RESEARCH LABORATORY  
SUBMARINE BASE, GROTON, CONN.



REPORT NUMBER 1062

BODY WEIGHT CHANGES BEFORE AND AFTER SUBMARINE PATROLS

by

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Naval Medical Research and Development Command  
Research Work Unit MF58, 524, 003-0004

Released by:

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Commanding Officer  
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## SUMMARY PAGE

### PROBLEM

The relatively long confinement, lack of exercise, and good food associated with the long patrols of modern submarines might cause a problem of excessive weight gain leading to an overweight condition post patrol.

### FINDINGS

The data of 670 men from 7 patrols shows that there was an average weight loss of 2.67 pounds from the start to the end of a patrol.

### APPLICATIONS

An overweight problem amongst Navy submarine personnel cannot categorically be ascribed to long deployments. These results may be helpful to Command Fitness Coordinators in the development of their programs.

## ADMINISTRATIVE INFORMATION

This work was conducted as part of the Naval Medical Research and Development Command Work Unit MF58.524.003-0004. It was submitted for review on 21 August 1985, approved for publication on 25 September 1985, and designated as NSMRL Report No. 1062.

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# ABSTRACT

Analysis of pre- and post-patrol body weight of 670 men from the crews of seven submarines showed that 32% of the men gained weight, 52% lost, and 12% did not change. From the magnitude of individual weight losses, it was inferred that as many as a third of the men may have been actively dieting. These data do not support the widespread belief that men tend to gain weight during submarine patrols.



## BODY WEIGHT CHANGES BEFORE AND AFTER SUBMARINE PATROLS

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Submarine work generally does not require great physical exertion, and non-work physical activity is restricted by the submarine's confined quarters. If regular exercise is to be obtained, it must be in the form of a program of "work-outs." Although such programs are now generally encouraged, it is often difficult to find the time to pursue one, since the at-sea workload averages 12 hours a day (Beare, Biersner, Bondi, and Naitoh, 1980). It has been shown by the pedometry measurements, that "activity levels" are reduced by as much as 50% aboard the submarine (Bondi and Dougherty, 1985). Food, generally considered to be the most appetizing in the Navy, is almost continuously available in any quantity desired, and the mess decks are the social center of the ship. The above scenario of decreased activity and ample food intake, would lead one to hypothesize that submariners are apt to gain weight during the course of a 70-day deployment.

One of us (KB) observed a net loss of weight of approximately four pounds per man for the crew of a fleet ballistic missile (FBM) submarine on which he was conducting an experiment. This observation is clearly at odds with the supposition that weight gain is common. Pre- and post-patrol weights of 670 men from the crews of seven FBMs were available, having been collected as one variable in larger studies. Although the generality of the findings is limited by the absence of a systematic sampling procedure, the results may be of interest to those concerned with the health of submariners and others interested in weight control during periods of lengthy confinement.

### Analysis and Results

Analysis consisted simply of subtracting each man's weight at the start of the patrol (SW) from his weight at the end (EW), and tabulating the remainders. Average SW and EW for each of the seven submarines are given in Table 1. For the total sample of 670 men, the average SW was 177.4 pounds, and the average EW was 174.6. The average change in weight was a loss of  $2.68 \pm 1.81$  pounds ( $p < .01$ , t-test).

The change in weight was not uniform. The simplest summary of the tabulation of changes is that, of the 670 men, 211 (32%) gained, 82 (12%) were unchanged, and 377 (56%) lost. A more detailed breakdown is shown by the histogram in Figure 1. Inspection of Figure 1 reveals that the majority of the changes, gain or loss, were of five pounds or less. Only 48 men (7.1%) gained 10 or more pounds, but 133 (19%) lost 10 or more.

TABLE 1

## BODY WEIGHT AT START AND END OF SUBMARINE PATROLS

<u>SUBMARINE</u>	<u>N*</u>	DATA COLLECTION (TIME WEEKS)	START	END	START MINUS END	P-VALUE (T-TEST)
			WEIGHT (LBS.)	WEIGHT (LBS.)	WEIGHT (LBS.)	
JA	136	10	178.9+28.0	176.3+23.4	-2.7	<0.001
JB	145	8	176.2+25.0	175.4+23.1	-0.8	<0.001
JC	39	10	177.1+31.2	174.0+29.3	-3.1	<0.01
B	148	6	178.5+26.5	174.2+22.6	-4.3	<0.001
R	144	10	182.4+29.2	177.8+22.7	-4.6	<0.001
K	18	6	171.1+25.8	168.9+24.1	-2.2	N.S.
G	40	4	177.7+22.5	175.7+21.0	-2.0	<0.001
MEAN $\pm$ SD			177.41+3.41	174.61+2.83	-2.67+1.81	<0.01

\* The large numbers represent data from whole crews, while the smaller numbers represent data from a function of the crew participating in a larger study.



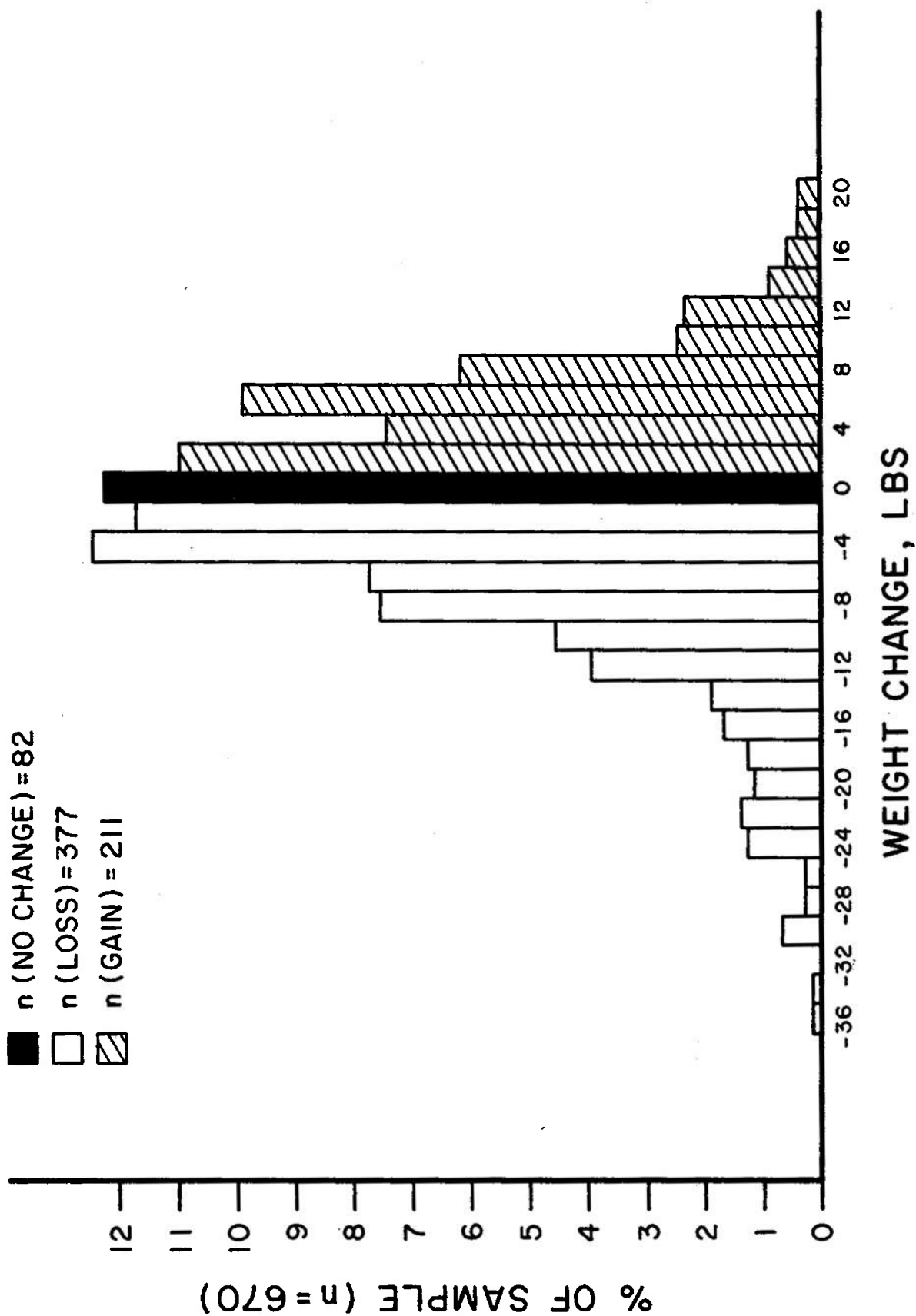


Figure 1. Histogram of the distribution of weight changes (i.e. end weight - start weight). The ordinate is % of the total of 670 men. Each bar represents a two-pound interval.

## Discussion

Men who experienced no change or a loss of weight outnumbered those who gained by a ratio of more than 2 to 1. Thus, in a statistical sense, men generally do not tend to gain weight while on patrol. However, many of the gains and losses seem too large to be ascribed to a statistical artifact, and a very plausible explanation of the large losses may be ascribed to a conscious effort to lose weight. This effort would include formal or informal dieting. Thus, it may be inferred that perhaps 15% of the men were actively trying to control their weight. Most of the subject group recorded only small changes in weight: 402 (60%) gained or lost only +6 pounds. Another substantial group (43 men: 16.2%) lost between 8 and 12 pounds. Some proportion of these individuals may also have been consciously restricting their intake.

It might be argued that men would gain weight unless they consciously worked at controlling their intake. If this argument is accepted, it follows that the majority of crewmen are conscious of this possibility and do take appropriate corrective action. Naval health care professionals should find this encouraging news, because it implies that the Navy weight control programs are being accepted by a large number of individuals and that it is possible to control weight aboard underway submarines.

## Conclusion

The data presented strongly suggest that weight gain while on patrol is not a significant problem for the majority of submariners. This is not to say that overweight does not afflict a substantial number of men in the submarine force, but it does imply that the primary causes of such overweight are not to be found on board the submarine.

## REFERENCES

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